

Proposed South Pond Closure Approach Ludington Plant Site

PREPARED FOR: The Dow Chemical Company

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Introduction

The purpose of this memorandum is to outline the proposed approach for long-term management of inactive cells of South Pond, and, ultimately, closure of South Pond at The Dow Chemical Company's (Dow) former plant in Ludington. The plant, including South Pond, is currently owned and operated by the Occidental Chemical Company (OxyChem). The South Pond is part of OxyChem's active wastewater management system and currently serves 4 primary functions: heat loss, ammonia volatilization, reduction and settling of solids, and pH reduction. OxyChem holds the active NPDES permit that regulates discharges. Dow will close South Pond once OxyChem ceases operations. Several of the cells that make up the South Pond are inactive, one of which was covered with a vegetative cover in 2013 (the West Cell). The South Pond site features are depicted on Figure 1.

Desired Outcome

Dow is seeking Michigan Department of Environmental Quality (MDEQ) approval of closure of the inactive cells as they are taken out of service. Specifically Dow is seeking MDEQ approval of the recently completed actions at the West Cell as the final remedy as well as for the proposed closure approach for the East and Secondary Cells. Agency approval is desired at this time to help facilitate a conservation-focused revitalization effort around Pere Marquette Lake and River, which includes South Pond.

Regulatory Background

NPDES Permit

South Pond is an integral part of OxyChem's wastewater management system and discharges from it are regulated under an NPDES permit issued and administered by the MDEQ Water Resources Division (WRD). One of the conditions of the current permit requires that an exfiltration study be completed to evaluate leakage from South Pond. Dow and OxyChem have completed three phases of work associated with the exfiltration evaluation and submitted the results of each phase of work to the MDEQ-WRD (CH2M HILL 2009, 2010, and 2012). The key conclusions of the exfiltration study were: the South Pond is losing (exfiltrating) water through the base of the active ponds (~270 gallons per minute in 2012); groundwater flow is towards and upward into the adjacent Pere Marquette River and Lake; and all exfiltrating groundwater appears to be ultimately discharging to the Pere Marquette River and Lake. WRD personnel have indicated that their primary concern is whether it has been demonstrated that all water is discharging to the lake/river system and not creating a larger groundwater plume. Work completed by Dow and OxyChem indicated that it is not creating a larger groundwater plume, as supported by the exfiltration studies.

Dow and OxyChem have indicated that work associated with the exfiltration study is complete. OxyChem has requested that exfiltrating groundwater from South Pond be included under its NPDES permit and WRD has indicated this may be possible. The calculated mass loading of chlorides from the South Pond, when added to discharges at the outfall, is within OxyChem's permit limits. However, ammonia levels measured in

groundwater adjacent to South Pond may not meet current permitted concentration-based levels in the NPDES permit.

Lagoon Closure

In accordance with MDEQ rules and policy (OWMRP-115-25; PA 457 Part 115), lagoons that received wastewater after 1978 are to be closed in accordance with Part 115 rules for Type III landfills. In a meeting with Dow on April 21, 2014 MDEQ indicated that the entire Ludington site may be subject to Part 111 and that Part 111 rules could apply to closure of the South Pond inactive cells. Dow and OxyChem believe this is not correct and will be providing information supporting their position to MDEQ. For the purposes of this evaluation we have assumed that the inactive cells will be closed as lagoons pursuant to Part 115.

Available information on the history and characterization of the South Pond solids are currently being developed for submittal to the MDEQ. Key conclusions affecting the proposed closure include the following:

1. West Cell of South Pond may have been inactive by 1978 (date that the cell was taken out of service is not known with certainty, but was sometime in the late 1970's to early 1980's)
2. Wastewater was discharged to all South Pond cells prior to October 7, 1993
3. Solids are classified as exceeding inert criteria and are not hazardous waste; and
4. Groundwater impacts exist.

In accordance with policy OWMRP-155-25 (Table 1 – Requirements for Management of Sludge's from Lagoons Constructed before October 7, 1993); the following are required for closure.

Develop and implement a Response Activity Plan (RAP) that may require:

- a. A clean cover;
- b. Financial assurance;
- c. Gas management;
- d. Groundwater monitoring;
- e. Consent order; and
- f. Deed restriction.

The policy further states that any groundwater contamination associated with operation of the lagoon would need to be remediated in accordance with Part 201 before the lagoon could obtain clean closure status.

Summary of South Pond Characterization

The history of the South Pond, use, and characterization of the lagoons and residual solids has been provided under a separate memorandum (CH2M HILL 2014). The following briefly summarizes key information relevant to understanding of the proposed remedy.

Pond Solids: The solids that have accumulated in the inactive cells consist primarily of solids that have settled out of wastewater from the following processes:

- Solids from relime and Moore Filter from calcium chloride plant (1962-Present)
- Solids from magnesium hydroxide plant (1962-2003);
- Solids from lime production (1962-2000);
- Fly ash from onsite power plant (1962-1972); and
- Catalyst plant solids (1972-1985).

Solids were analyzed by Dow as part of the processes for evaluating their reuse as agricultural lime. The solids primarily consist of calcium and magnesium hydroxides and carbonates. There were no volatile organic compounds or semi-volatile organic compounds detected in the samples analyzed. Samples were also analyzed by the toxicity characteristic leaching procedure (TCLP) for metals, volatiles and semi-volatiles and were classified as non-hazardous (Dow 2001 and 2002).

Wastewater discharged to the ponds also contain elevated levels of dissolved chloride (121 to 1,650 mg/L) and ammonia (17 to 60 mg/L) from the calcium chloride plant (CH2M HILL 2009). Evaluation of groundwater beneath and adjacent to South Pond has determined the elevated concentrations of ammonia, chloride, and total dissolved solids (TDS) exists in groundwater as a result of leakage from the base of the pond (CH2M HILL 2009).

Proposed Approach

The technical approach described below is based on the constituents present in the solids, the hydrogeologic site conditions, the nature and extent of impacts at the site, environmental benefits, and considerations of future land use plans endorsed by the community.

The selected alternative will satisfy the requirements of Part 115 and Part 201 rules. For purposes of this evaluation, we will discuss the proposed closure process in terms of Part 115.

Interim Response Activity Plan for Residual Solids

Dow will submit to MDEQ for review and approval an Interim RAP (IRAP) which will address the residual solids for inactive cells where closure is desired. Groundwater will be addressed separately because there are active cells from which water is exfiltrating at approximately 270 gallons per minute, making it extremely difficult to separate potential groundwater impacts from water exfiltrating from active cells versus from residual solids in inactive cells. A similar approach was followed for the Dow Sixth Street Pond¹ closure in 2001 that was approved by MDEQ pursuant to Part 115.

The IRAP and associated actions may include:

- Construction of a vegetative cover over the residual solids in the inactive East and Secondary Cells. The design will be based upon pilot studies previously completed at the site. Additionally, the previously completed vegetative cover for the West Cell may be included in the IRAP.
- A groundwater monitoring plan will be submitted with the IRAP for MDEQ approval and will be implemented upon approval. Future monitoring may be adjusted with MDEQ approval based upon the results of the initial monitoring program.
- A contingency plan will be submitted with the IRAP for MDEQ approval that will address the residual solids.
- A restrictive covenant will be filed with Mason County. The covenant will prohibit the use of groundwater, prohibit disturbance of the vegetative cover, and restrict land use to non-residential purposes.

The vegetative cover will consist of the following elements:

- Minimum six-inch sand grading layer/capillary barrier.
- Minimum six-inch topsoil layer (up to 3-4 feet in areas) seeded with an assortment of upland, native prairie species.
- Small perennial wetlands lined using a PVC liner with a minimum 12-inch topsoil layer, planted with native wetland species.

¹ Sixth Street Pond received solids from the Ludington Plant prior to the opening of South Pond. The Sixth Street Pond was taken out of service once South Pond became active in 1962.

- Additional larger woody species planted in areas with deeper topsoil.

The purpose of the cover is to achieve the following objectives:

- Prevent direct contact with residual solids by humans.
- Prevent windblown erosion of dried solids.
- Provide a substrate to develop a vegetative cover. Native vegetation will be selected based on the ability to provide an ecologically diverse environment suitable for the unique location. Habitats that will be developed will include seasonal wetlands and upland terrestrial areas with both prairie and scrub/shrub environments.
- Limit infiltration of precipitation through the residual solids by containing water in lined wetland areas and the uptake of water through evapotranspiration.

Groundwater

There are several mechanisms through which groundwater may be addressed. Although groundwater will be addressed separately, some mechanisms may include the following:

- Groundwater discharges to the Pere Marquette River and Lake may be permitted through OxyChem's NPDES permit. OxyChem has requested that the exfiltration be included in their NPDES permit and the incremental discharge from the inactive cells is insignificant relative to the exfiltration from the active cells.
- Upon cessation of operation of South Pond (or elimination of exfiltration through a change in the configuration of the active cells) Dow will conduct an evaluation to assess the need for response actions for groundwater. The assessment may include conducting an ecological assessment, evaluation of the applicability of a mixing zone, and/or evaluation of remedial alternatives. The evaluation and approval process will proceed consistent with Part 201 rules and regulations.

References

CH2M HILL 2014, *South Pond Area – History and Investigative Summary Occidental Chemical Company Plant Site, Ludington, Michigan, May 2014*

CH2M HILL 2009, *Dow Ludington Plant Site, 2008 Exfiltration Study Report, February 2009*

CH2M HILL 2010, *Dow Ludington Plant Site, Exfiltration Study Groundwater Field Investigation Report, March 2010*

CH2M HILL 2012, *Ludington Plant Site Exfiltration Study, Phase III – Field Investigation, October 2012*

Dow 2001, Facsimile from Dow to MDEQ, Subject: Information on Agricultural Lime Materials, November 9, 2001

Dow 2002, Letter from Dow to MDEQ, Subject: Total Metals Analysis of Agricultural Liming Residuals, March 5, 2002

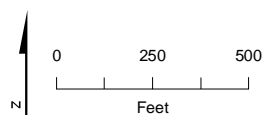
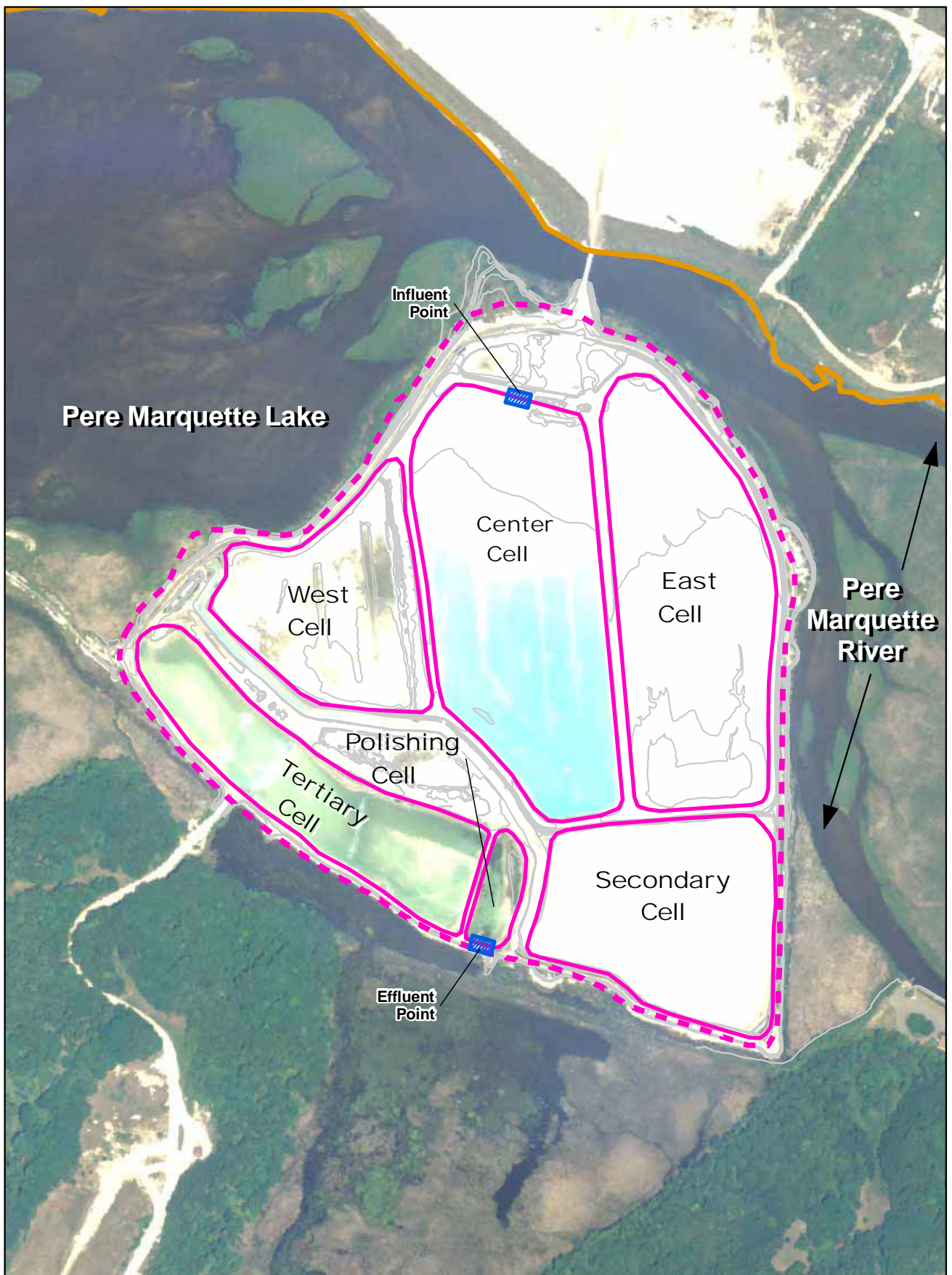


Figure 1
 South Pond Site Features
 Proposed South Pond Closure Approach
 Ludington Plant Site
 The Dow Chemical Company
 Ludington, MI